# Lead in Drinking Water Sampling

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## Outline

- Purpose of Study
- Partnership with Chicago
- Overview of Study
- Study Findings
- Preparing for Study Publication
- Service Line Particulate
- Additional Chicago Activities Related to Lead

## Purpose of Study

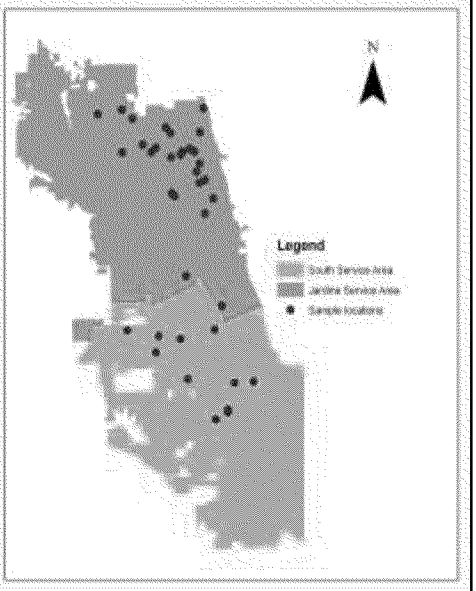
- LCR sampling has not changed since 1991
  - Different first-draw protocols used by public water systems
  - Leaded solder was banned effective in 1988
- Additional information available research and unintended consequences of system treatment changes
- EPA is proposing long-term revisions to the LCR
  - Include a review of current sampling requirements

## Partnership with CDWM

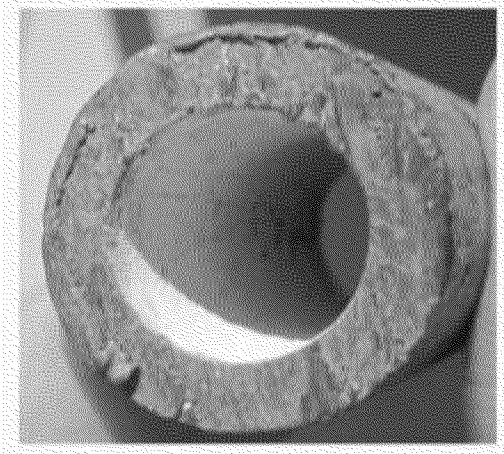
- EPA R5 partnered with CDWM to conduct a sampling study
  - EPA solicited volunteers for sampling study, collected/analyzed samples, measured/estimated LSL lengths at each site
  - Volunteers collected samples from their homes, provided plumbing/other information
  - CDWM provided information on water quality, water mains, service line materials, metering/water usage, work reports on sampling sites

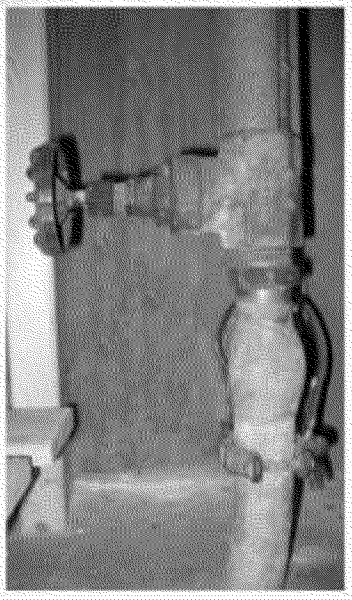
# Overview of Study

- 32 SFRs with LSLs
- 3 rounds of monitoring at most sites
  - Mar/Apr 2011
    - 4 first-draw and 45 sec flushed samples
  - June 2011
    - 12 sequential samples
  - Sept/Oct 2011
    - 11+ sequential samples, 2 first-draw samples, and flushed samples (3 min, 5 min & 7 minute)



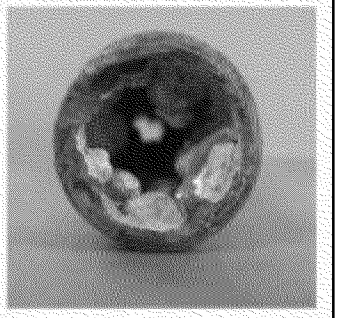
## Lead Service Lines





## First Round

- First round (4 samples)
  - First-draw sampling without pre-flush (NHU)
  - 45 second flushed sample following 2nd FD NHU sample
  - First-draw (FD) sampling with 5 min pre-flush (PF)
  - 45 second flushed sample following 1st FD PF sample
- 45 second flushed samples discontinued after first round due to corroded galvanized pipe affecting timing



•The sampling was conducted over two days:
•The first day (without pre-flushing the tap the night before) and following a minimum stagnation time of 6 hours during which residents were instructed not to use water in the home, a first-draw sample was collected, followed by running the water for 45 seconds and collecting a second (45 sec flushed) sample.
•The night before the second set of samples were collected, the tap was flushed for 5 minutes and residents were instructed not to use any water in the home until samples were collected the next day. A minimum stagnation time of 6 hours was used.
•The following day a first-draw sample was collected, followed by running the water for 45 seconds and collecting a second (45 sec flushed) sample.
•Dates/times were recorded by volunteers.
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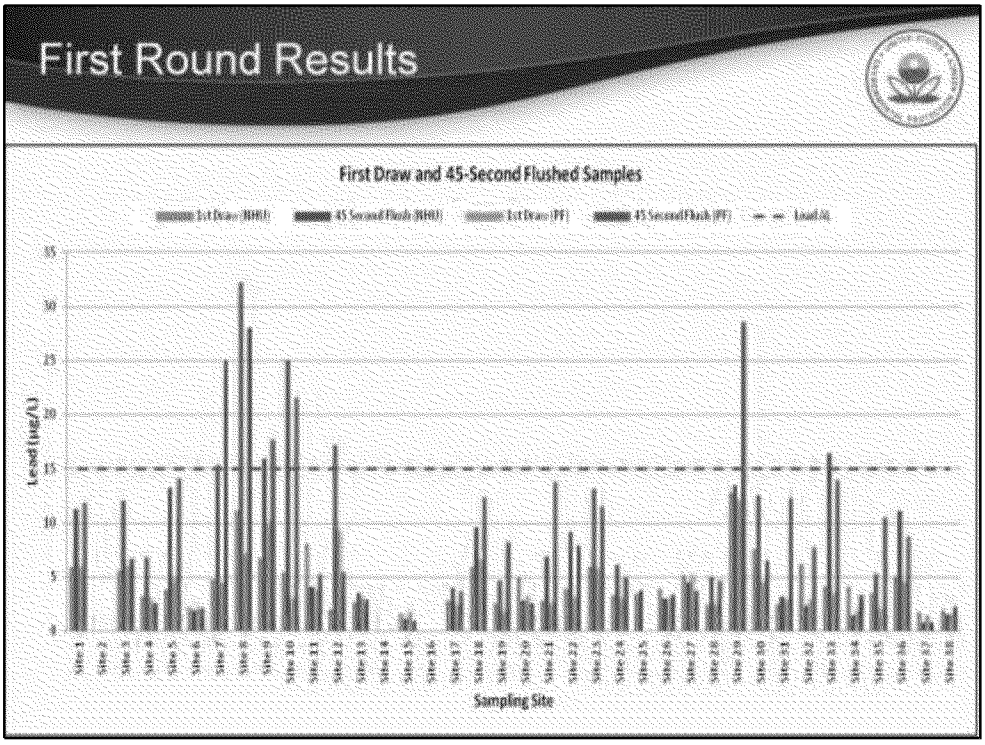



•All First-draw results, with and without pre-flush were below the lead action level.
•At same sites, a number of the 45 second flushes samples following the first-draw samples were above the lead action level.
•Some sites initially thought to have LSLs did not have them and were excluded from further sampling.
•One site initially thought not to have a LSL did have a LSL.
•Results show that EPA's 3-0-45 second flushing instructions before drawing water for consumption can take residents with LSLs to higher lead.

## Overall First-Draw Results

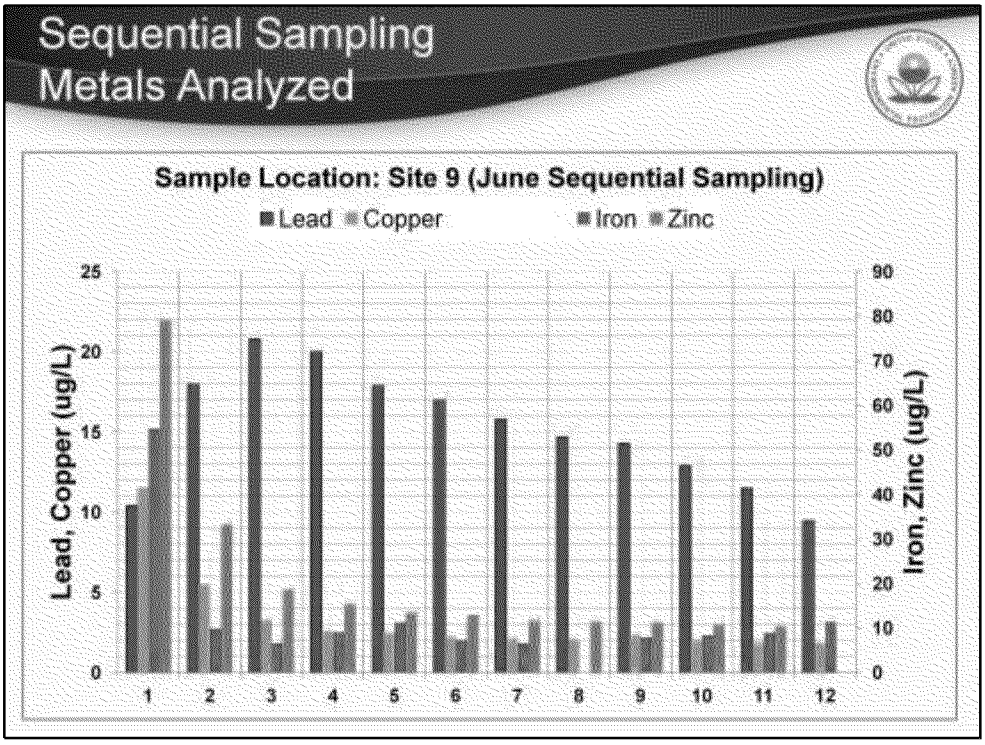
| Summary of NHU and PF First-Draw Results | | | | | |
|---|---|---|---|---|---|
| | NHU (Mar/Apr) | PF (Mar/Apr) | PF (June) | NHU (Sept/Oct) | PF (Sept/Oct) |
| 90th %ile Pb Value (ug/L) | 8 | 7 | 8 | 10 | 9 |
| No. of Samples | 32 | 32 | 28 | 29 | 30 |
| No. Above AL | 0 | 0 | 0 | 2 | 1 |

•The NHU results were higher overall than the corresponding PF values for most sites. The PF first-draw protocol produced lower individual results than NHU first-draw protocol in 23 of 32 sample pairs in March/April, and 20 of 27 sample pairs in Sept/Oct.
•Although NHU first-draw samples were collected without directing the residents to flush the tap, showering, washing dishes or doing laundry prior to the stagnation period could influence NHU first-draw sample results similar to pre-flushing the tap. As shown in Figure 2, higher lead levels were present at the time of sampling than what was captured by either first-draw protocol.
•First-draw results were slightly higher than, but consistent with Chicago's compliance data going back to 1999 (average 90$^{th}$ percentile was 6 ug/L). The first-draw 90$^{th}$ percentile results for all rounds in the study were below the AL with only 3 samples above the AL in all sampling conducted.

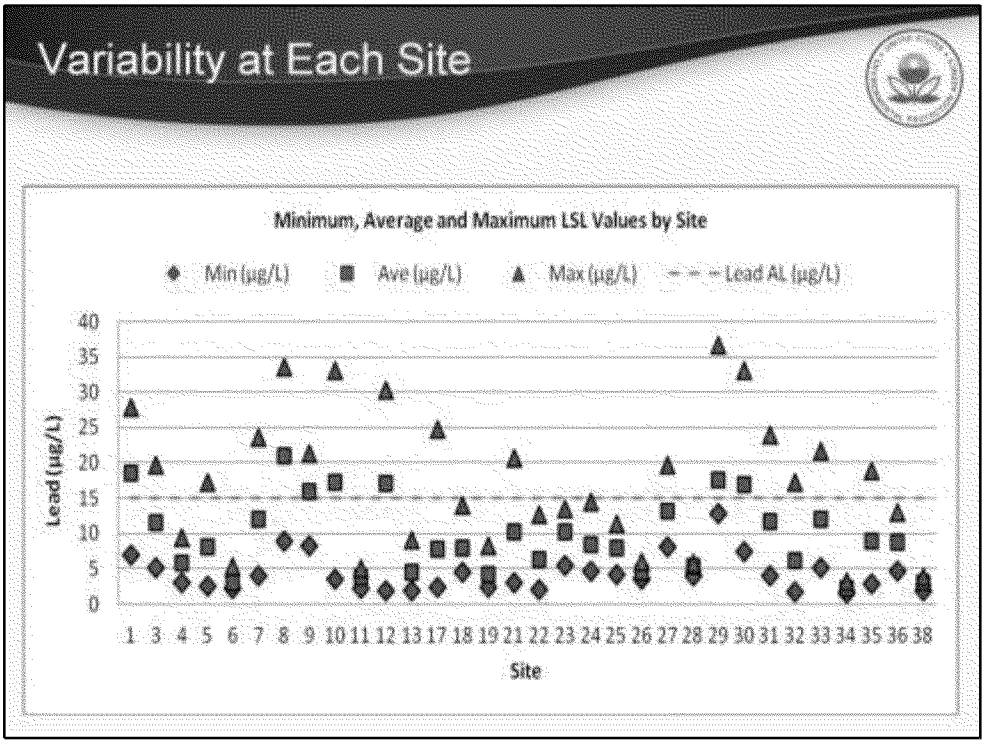
## Sequential Sampling

- 12 sequential one-liter samples were collected in June at each site.
- At least 11 sequential samples were collected in Sept/early Oct at each site.
  - Additional sequential samples were collected at some sites with higher results, but are not used in the analysis to avoid skewing.
- Residents were instructed to flush the tap for 5 minutes the night before and then not to use any water in the household until samples were collected the following morning.

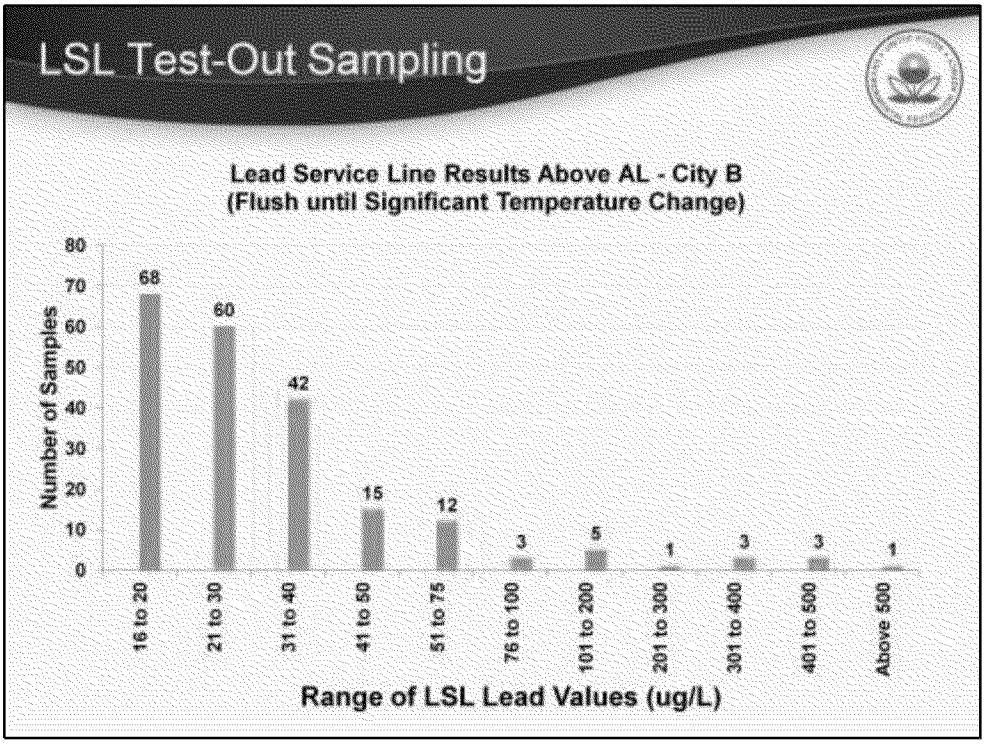
Samples were collected one after the other without turning the water off.



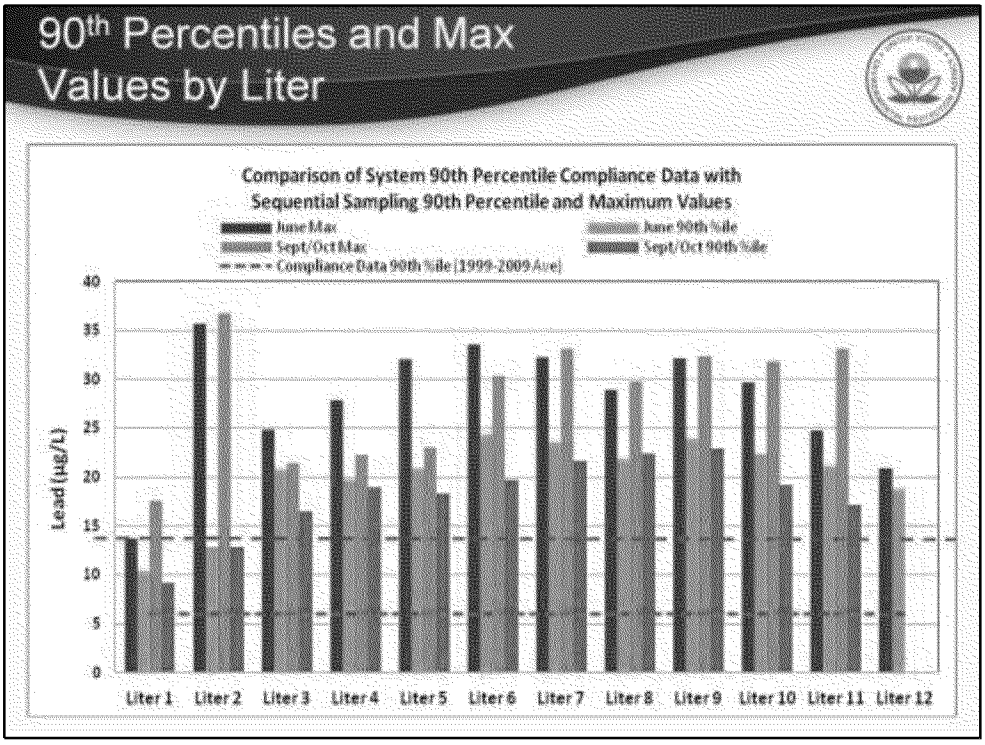

•This is an example of the metals analyses. This site has a short stretch of interior galvanized pipe before hitting the meter and LSL.
•Cu and Zinc indicate brass consistent with the meter.
•Cannot distinguish whether lead is from LSL or meter.
•Beyond the internal plumbing, you see the iron from the galvanized pipe tail off, but can still see the trailers of zinc and iron throughout, indicating the later samples are picking up metals passing through the interior plumbing.
•The trace iron could be from the main (Chicago uses a blended phosphate).




•Using the 12 sequential samples from June and first 11 samples from Sept/Oct, the chart shows the variability of lead levels at each site.
•Many sites would be over or under the lead action level, depending on the liter selected as the compliance sample.
•The length of pipe to the beginning of the LSL was also widely variable. In some places, the LSL was hit in the 1st/2nd liter, but at most sites there was a variable length of internal plumbing before hitting the LSL.

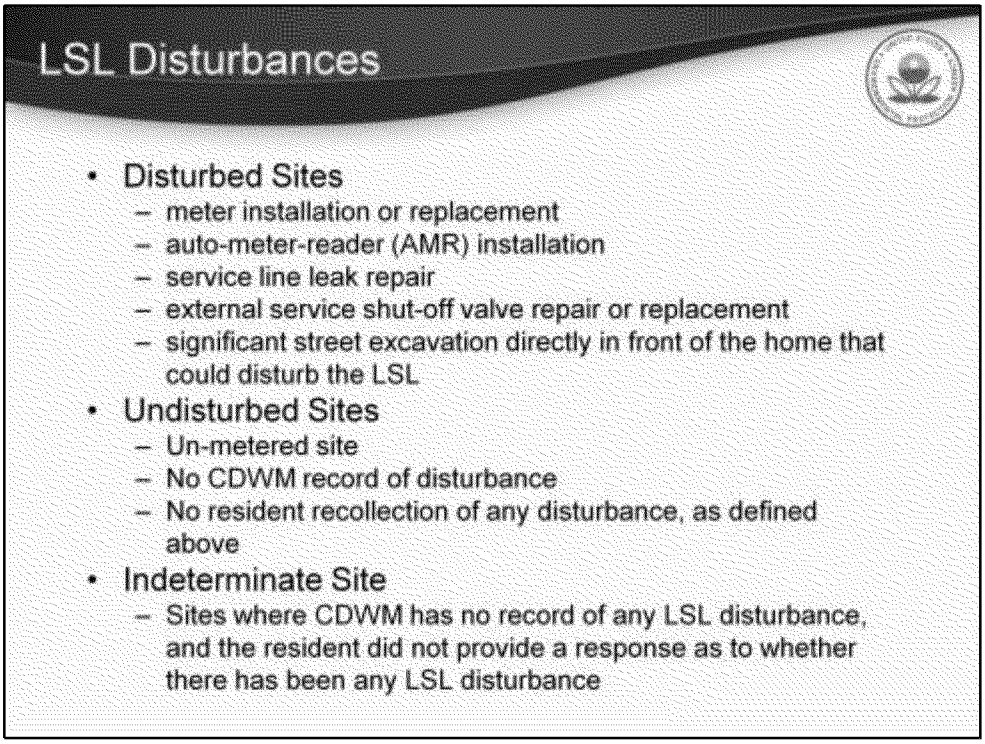



•This is data from a second system that exceeded the Pb AL and had to undertake LSLR activities.
•Sampling protocol was from LCR (flush until significant change in temperature).
•Results show significant variability in LSL lead levels across the system.
•Total number of samples collected was 1925; with 1,762 results (89%) below the lead AL; and 213 results (11%) above the lead AL.
•LSL results above the AL ranged from 16 µg/L to 580 µg/L with 28 sample results in exceedance of 50 µg/L.




•This chart plots all results for the same liter across all sample sites and shows the 90th percentile values and max values if a specific liter were used for calculating the 90th percentile value for the system.

•The initial and final liters are likely biased low because they capture interior plumbing after pre-flushing and some of the shorter LSL sites may capture water from within the water main.



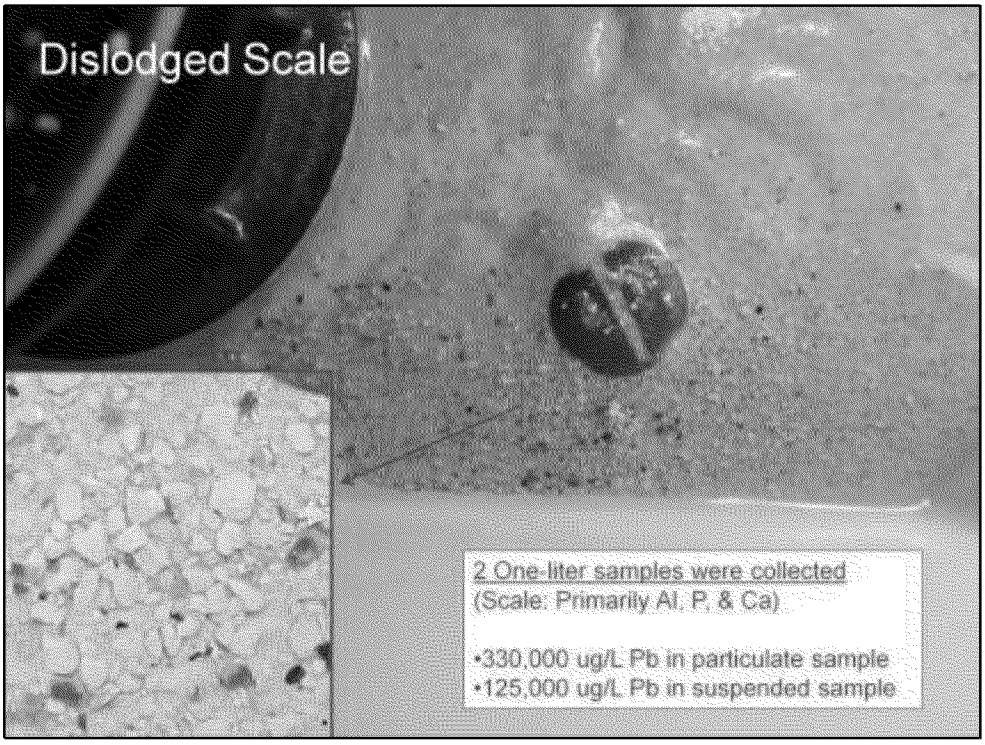

•We use the third category because the cross-checking was important.
•It's good to ask residents for information. In some cases, residents provided information that was not reflected in CDWM records. Upon further investigation, CDWM information resulted in reclassification of the site.

# LSL Disturbances

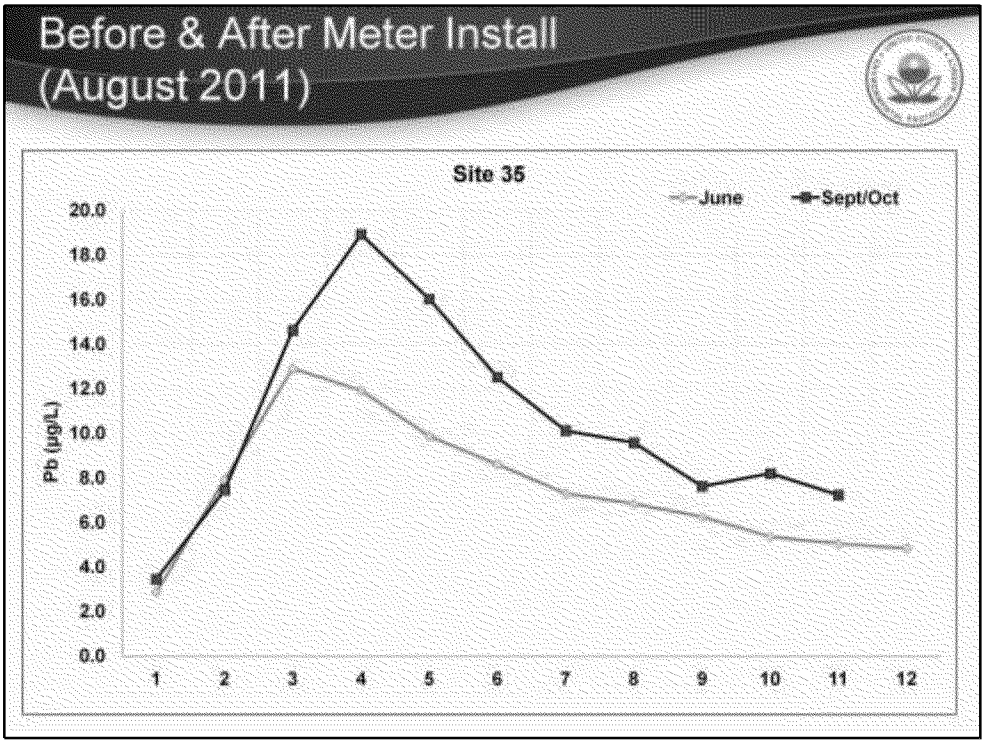
| | | |
|---|---|---|
| # of Disturbed Sites | 13 | % of Samples over AL: 36% |
| Total Samples Collected | 327 | |
| # Samples Above AL | 117 | |
| # of Undisturbed Sites | 16 | % of Samples over AL: 2 % |
| Total Samples Collected (Undisturbed) | 372 | |
| # Samples above AL | 6 | |
| # of Indeterminate Sites | 3 | % of samples over AL: 37% |
| Total Samples Collected | 81 | |
| # Samples above AL | 30 | |


•During water main work, the jarring about 12 feet away in the street sprung a leak in the lead service line at the service shut-off valve (solder joint).
•Water was bubbling up to the surface.

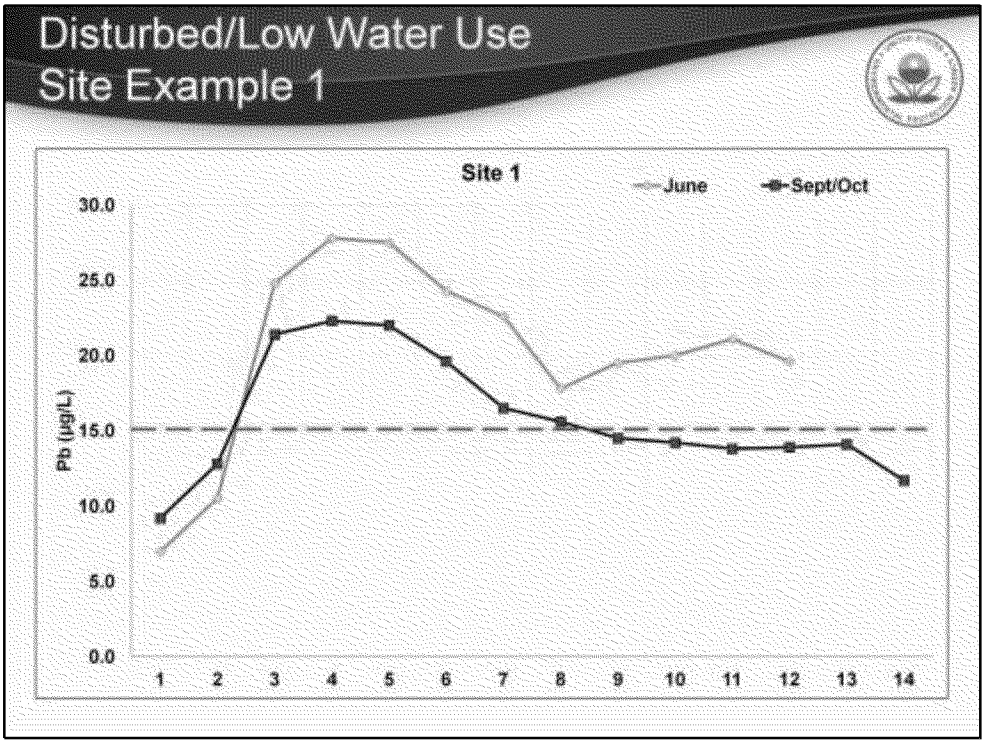
# Fixing the LSL Leak



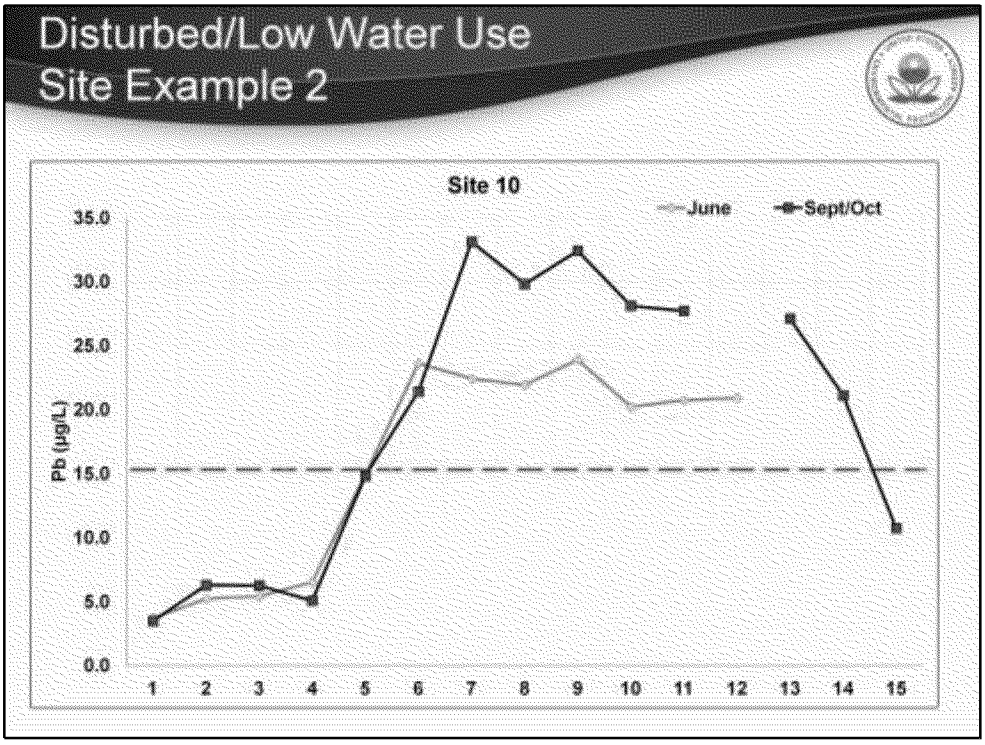

Using an improvised particulate collection system, the particles were collected into a one-liter sample bottle filled with the tank water. The remaining water with suspended particles was collected into a second one-liter bottle.




A meter was installed in a meter pit in front of this home in August (in-between sequential sampling events).




Meter Install, apparent normal water use. Information provided by resident indicates low daily use almost all of the time and incidences of high volume use over 1-2 day periods.




LSL leak repair, average monthly water use was 1,826 gallons.
This and some other sites were why we collected additional sequential samples at some sites, to inform residents as when the levels came down.

## Preparing for Publication

- Peer review comments received on manuscript
  - Due date for revised manuscript is April 24
  - If revisions/responses are acceptable, posting to ES&T website could happen shortly thereafter (within days)
- Meanwhile…
  - R5 is developing a website with information on lead service lines
  - Preparing a desk statement (will coordinate with Chicago, IEPA, EPA HQ)

# Additional Chicago Activities

- Add Chgo slides